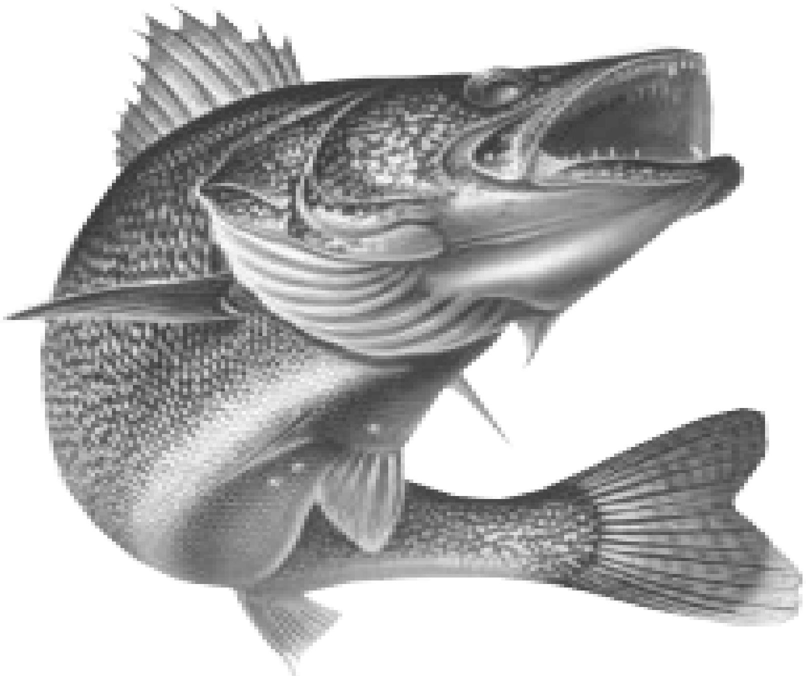
All actual presentations (#1-25) may be viewed by merely clicking on the title.



2006 Coolwater Fish Culture Workshop – January 8-10, 2006 Wintergreen Resort &Conference Center, Wisconsin Dells, Wisconsin

Hosted by the Wisconsin Department of Natural Resources

Sponsors:

Wintergreen Resort and Conference Center – meeting room consideration
Gander Mountain Baraboo store - discount coupons
Fish Pro Consulting Engineers and Scientists – donation for meeting expenses

Walleye Session

1. A COMPARISON OF COMMERCIAL DIETS FED TO WALLEYE FINGERLINGS FOR GROW-OUT, presented by Donna Hanen Muhm*.

*Donna Hanen Muhm
122 252nd Avenue
Spirit Lake, IA 51360
Tel: 712-336-1840
Fax: 712-336-0921
Email: ***donna.muhm@dnr.state.ia.us***

Intensive rearing to produce six-inch walleye at the Spirit Lake Hatchery has traditionally involved both a training or habituation phase and a grow-out phase. In the training phase, nursery lake-reared walleye are brought into the hatchery and trained to consume a commercially manufactured artificial diet. The diet most successful in the 2004 trial was used exclusively in the 2005 season. This diet was INVE Lansy Epac.

There has been considerable difficulty reaching the target length with any grow-out diet. In the 2004 trial, we requested Nelson and Sons prepare a modified diet to the federal formulation 9901. This diet was reformulated Walleye Grower 0401 and was shown to be a superior transition phase diet. It had similar growth results and imparted a more natural color to the fish. Since the 2004 study was considered to have density-dependent bias, it was repeated in 2005. We also looked at relative weight to determine any impact on trainability and survival.

Initial 20 day growth in the grow-out phase showed walleye grower 0401 fish had a greater mean length (4.62 inches) than 9206 fish (4.56 inches) and a greater increase in mean total length (1.06 inches versus 0.98 inches). By the end of the 70-day grow-out study both diets had very similar results, and both attained an average length of greater than six inches. Overall percent survival was similar. Relative weight in the 0401 fish at the end of the trial was 100.88 compared to 103.6 in the 9206 fish. The same color differences seen in the 2004 study were again seen in 2005. Since density was relatively constant, it was not considered to be a factor and there seems to be no advantage to using the more costly 0401 diet.

2. AN OVERVIEW OF WALLEYE FINGERLING PHASE I PRODUCTION AT RATHBUN FISH HATCHERY, presented by Chris Clouse*.

Authors: *Chris Clouse[1] and Randy Esser[1]

*Chris Clouse
[1]Rathbun State Fish Hatchery
15053 Hatchery Place
Moravia, IA 52571
Tel: 641-647-2406
Fax: 641-647-2609
E-mail: Chris.clouse@dnr.state.ia.us

Since 2000 Rathbun Fish Hatchery has been using 1 acre lined ponds to raise walleye fingerlings. From 2001 to 2005 our goal was to produce as many walleye fingerlings that we could that were at least 800/pound with at least 50% survival. Based on production results for 47 ponds harvested over 5 growing seasons the survival goal has been met 94% of the time, the size goal has been met 23% of the time.

Larger fingerlings at the start of feed training have a higher final survival through the feed training phase. If walleye are to be feed trained ponds should be stocked at low densities (i.e. 50,000 – 75,000 fry per acre) to produce large fingerlings (i.e. less than 800/pound). Management of ponds for large fingerlings must focus on providing high numbers of chironomid larva as prey for growing fingerlings. Chironomid populations are highest when organic fertilizers are used.

3. AN EVALUATION OF THE STOCKING DENSITY OF WALLEYE *SANDER VITREUS* FRY IN PLASTIC-LINED PONDS, presented by James B. Rudacille*.

Authors: *James B. Rudacille[1], J. Alan Johnson[1], Christopher P. Clouse[1], and Joseph E. Morris[2]

[1]Iowa Department of Natural Resources
Rathbun Fish Culture Research Facility/SFH
15053 Hatchery Place
Moravia, IA 52544
Tel: 641-647-2658
Fax: 641-647-2690
E-mail: Jay.Rudacille@dnr.state.ia.us

[2]Department of Natural Resource Ecology and Management
Iowa State University
124 Science II
Ames, IA 50011-3221
Tel: 515-294-4622
Fax: 515-294-7874
E-mail: jemorris@iastate.edu

The use of plastic-lined ponds instead of earthen ponds is becoming increasingly commonplace as agencies renovate existing fish culture facilities or construct new ones. However, the use of plastic-lined ponds for fish culture is a relatively new practice and there is limited information available regarding their management. While there are many aspects relating to pond management, our area of focus was to evaluate the stocking density of walleye (*Sander vitreus*) fry in plastic-lined ponds. Study objectives were to produce walleye with a mean weight of at least 0.568g and mean survival rates of at least 50% within a 30- to 40-day culture period. Other areas of interest were to determine how stocking density affected prey availability as well as water quality.

During the five-year study, which spanned 2000-2004, four stocking densities were evaluated. These stocking densities (and their English equivalents) are as follows: 185,325 fry/ha (75,000 fry/acre), 247,100 fry/ha (100,000 fry/acre), 370,650 fry/ha (150,000 fry/acre), and 494,200 fry/ha (200,000 fry/acre). These stocking densities were chosen because they represented a good cross-section of published stocking densities for earthen ponds.

With the first year of the study being the exception, survival rates have been excellent. In 2000, survival rates for the three stocking densities being evaluated were all less than

50%. From 2001-2004, the objective for survival rate was exceeded in every stocking density. During these years, the lowest survival rate observed was 69% and the highest survival rate was 95%. There were no differences (*P*>0.05) between stocking densities in any one year.

The success in exceeding the objective for survival was not duplicated for fish size. In fact, the objective for fish size was exceeded only three times. In 2000, the mean fish size was 0.572g in ponds stocked with 494,200 fry/ha. However, fish size in this treatment was artificially inflated due to the extremely poor survival (14%). The targeted fish size was exceeded in the 247,100 fry/ha treatment in 2002 when mean fish weight was 0.713g. In the 185,325 fry/ha treatment in 2004, the objective for fish weight was exceeded when mean fish weight was 0.689g. Finally, in 2004, fish in the 185,325 fry/ha treatment were significantly larger (*P*=0.0202) than fish stocked at a rate of 247,100 fry/ha. In summary, ponds stocked at lower densities produced larger fish than ponds stocked at higher densities.

4. EVALUATION OF WALLEYE FINGERLING SIZE ON HABITUATION SURVIVAL, presented by J. Alan Johnson*.

Authors: *J. Alan Johnson and James B. Rudacille

*J. Alan Johnson
Fisheries Research Biologist
Rathbun Fish Culture Research Facility
15053 Hatchery Place
Moravia, IA 52571
Tel: 641-647-2658
Fax: 641-647-2690
E-mail: alan.johnson@dnr.state.ia.us

Rathbun Fish Hatchery annually produces 150,000 advanced walleye fingerlings (200mm) using a tandem pond and raceway culture method. Small fingerlings (45 mm) are produced in extensive ponds then habituated to prepared diets in raceways and grown to the target size for sport fisheries enhancement. Poor survival during habituation of pond reared walleye fingerlings has been a limiting factor in the production of advanced fingerlings. Previous research at this facility determined diet and light environment are important factors in the success of habituation. Another factor, fish size, was identified as an important factor early in the development of habituation techniques. A size goal of 800 fish/lb was chosen based on anecdotal observations during that time at Rathbun Fish Hatchery. Size and condition of fingerlings harvested from our lined ponds has been variable, and we have met or exceeded the size goal only 20% of the time. Much effort has been expended to reach the size goal and pond stocking rates have been lowered to meet this goal. Therefore, directed research to compare survival of fingerlings of different size has been conducted to determine the effects of size on habituation survival.

The effect of initial fingerling size on habituation has been evaluated in three production scale experiments at Rathbun Fish Hatchery. All experiments were conducted in a dark environment with submerged lighting. All fish were fed Lansy CW (EPAC CW) 8/12 during the first ten days then converted to Walleye Grower 9206 for the remainder of the 28-day study.

Survival during the habituation process was significantly higher for larger fingerlings than for smaller fingerlings (Table 1) in 2004 and 2005. There was no significant difference between survival of two sizes of fingerlings in 2003.

Table 1. Comparison of initial size and habituation survival of walleye fingerlings during three culture seasons.

	Initial weight (g)	Survival (%)	P-value
2003	0.409	52.7	0.4901
	0.645	59.3	
2004	0.467	33.9	0.0157
	0.640	47.3	
2005	0.316	37.1	<0.0001
	0.420	54.7	
	0.525	69.7	

These results indicate that large fingerlings should be utilized for habituation purposes and smaller fish should be utilized for stream or lake stockings. Further research on methods to increase size of walleye harvested from the ponds should be conducted. Currently, reduction of pond stocking rate has been evaluated to determine the effect on fish size at harvest.

5. FEED-TRAINING WALLEYE FOR ADVANCED FINGERLING PRODUCTION, presented by James A. Held*.

Authors: James A. Held[1], Steve Merson[2] and Robert Fahey[2]

*James A. Held
[1]University of Wisconsin Aquaculture Program
302 South Main Street
Lake Mills, WI 53551
Tel: 920-648-2902
E-mail: ***jaheld@wisc.edu***

Walleye fingerlings destined for advanced fingerling production (>6in total length, TL) were harvested from a pond at 1.8 in TL and either stocked into a production pond (3000fish/ac) supplied with appropriately sized forage or moved indoors into tanks for feed training.

Feed training was accomplished in 30 gal circular flow-through tanks supplied with tempered water (18°C), directional flow and air stone aeration at a stocking density of 500 fish/tank. Tanks were illuminated using indirect incandescent lights. Fish were fed to excess using either Epac CW 8/12 (Inve Nutrition Salt Lake City, UT) or the same feed supplemented with crumbled freeze-dried krill (6 tanks per treatment). Fish were fed continuously using clock-type sweep feeders as well as hand fed 3 to 5 times daily. Tanks were cleaned and mortalities removed and counted daily. Fish were considered feed-trained when mortalities due to starvation ended and all remaining fish were actively feeding. Feed-training success was 97.6% and 86.5% for krill-supplemented and unsupplemented fish, respectively.

Feed-trained walleye were then stocked into a pond (3,000 fish/ac) and supplied with forage for the remainder of the growing season. Harvest returns were 96.5% at 8.83 in TL for forage run walleyes and 66.8% at 8.13 in TL for feed-forage fish. Feed and associated costs were $3685.73 and $2455.14 for forage and feed-forage walleyes, respectively. Cost per fish was $1.23 for each group. Harvest and economic results are based on 1 pond per treatment and as such should be interpreted with caution. More study is needed to conclusively compare the grow-out success of the 2 protocols. Improvements in feed-training technique are discussed.

6. FERTILIZATION OF WALLEYE PRODUCTION PONDS – 2005 UPDATE,
presented by Robert Fahey*.

*Robert Fahey
Lake Mills SFH
302 South Main Street
Lake Mills, WI 53551
Tel: 920-648-8012
Fax: 920-648-3646
E-mail: robert.fahey@dnr.state.wi.us

At the Lake Mills State Fish Hatchery (Wisconsin Department of Natural Resources), a 62% return (from fry to 1.5" fingerling) was achieved in earthen walleye ponds utilizing weekly nitrogen/phosphorus testing and inorganic fertilizer applications (Culver method). The previous fertilization regime consisted of the traditional weekly organic fertilizer applications and no nitrogen/phosphorus testing. The average rate of return was 21%.

Utilizing **bi-weekly** nitrogen/phosphorus testing and inorganic fertilizer applications, a **90 %** return rate was achieved despite the coldest post fry stocking water temperatures recorded at Lake Mills since 1988.

Currently, the nitrogen and phosphorus ratio of 20:1 is the target for green algae production in walleye rearing ponds. Maximums of 30 ug/l of phosphorus and 600 ug/l of nitrogen are added to the ponds via inorganic fertilizer (phosphoric acid and ammonium nitrate). The biweekly phosphorus and nitrogen levels are measured using a Hach DR2500 spectrophotometer and Orion PH meter linked to nitrate and ammonia ion specific probes. The inorganic fertilizers are then mixed in tanks, which are pond specific, and sprayed into the ponds.

In addition to increased fish production, the benefits of this fertilization regime are decreased filamentous algae and macrophyte production at harvest. The fertilizer is usually applied to the ponds for six weeks total. Even though plankton populations are depleted, the fertilizer will create algal turbidity to minimize cannibalism. Water clarity has increased due to early plankton blooms which overgraze the algae. Further experimentation with decreased phosphorus maximums (10 ug/l) may increase the badly needed algae blooms earlier in the rearing cycle.

Fish Health/INAD/Marking Session

7. OVERVIEW OF THE NATIONAL INAD PROGRAM, presented by Bonnie Johnson*.

*Bonnie Johnson
U.S. Fish & Wildlife Service AADAP Program,
4050 Bridger Canyon Rd.
Bozeman, Montana 59715
Tel: 406-994-9905
Fax: 406-582-0242
Email: bonnie_johnson@fws.gov

In April 1998, the U.S. Fish and Wildlife Service (Service) took a major step in expanding both the scope and magnitude of its Investigational New Animal Drug (INAD) program by opening participation on Service INADs to state, tribal, university, and private aquaculture facilities. Although initial participation in the program was limited to folks in the States of Alaska, California, Idaho, Montana, Oregon, and Washington, in January 1999 the program was expanded to include participation by facilities from throughout the entire United States. The new program was termed the National INAD Program (NIP), although it is more commonly referred to as “Piggy-backing” on Service INADs.

The NIP currently has over 230 federal, state, private and tribal aquacultural facilities signed-up to use 12 different INADs. The collection and submission of supportive data generated from INAD studies is a critical component in our pursuit of new aquatic species drug approvals. These data sets demonstrate treatment efficacy over a broad range of fish species, life-stages, disease conditions, and water quality parameters. These data also provide important evidence that treatments are not resulting in any unexpected or adverse effects under a similar broad range of treatment parameters. Such data, when submitted in combination with a smaller dataset of higher quality (“pivotal” data), play a key role in our efforts to obtain broad (i.e., “all fish”) drug labels. This presentation briefly describes the NIP and how an interested facility may participate.

8. HUMAN FOOD SAFETY RESEARCH ASSOCIATED WITH A PROPOSED ZERO WITHDRAWAL ANESTHETIC FOR FISH, presented by Jeffery R. Meinertz*.

*Jeffery R. Meinertz, and Theresa M. Schreier
U.S. Geological Survey
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, WI 54603
jmeinertz@usgs.gov, tschreier@usgs.gov

Currently, Finquel (MS-222) is the only fish anesthetic approved by the U.S. Food and Drug Administration (FDA). Use of this anesthetic is constrained by a 21-day withdrawal period. There is a critical need for use of an anesthetic with zero withdrawal time in U.S. public aquaculture and fishery management. A zero withdrawal anesthetic would allow anesthetized fish to be handled and released immediately after conducting nearly all fish culture and management procedures including transport, spawning, and age and growth studies.

AQUI-S™ is a fish anesthetic approved in New Zealand and Australia and is being pursued for approval in the U.S. as a zero withdrawal anesthetic. While pursuing the approval of AQUI-S™, a series of studies are conducted to fulfill data requirements for the following technical sections: (1) efficacy, (2) environmental safety, (3) human food safety, and (4) target animal safety. Data from these studies are submitted to the FDA who review the data and determine the suitability of the data to fulfill the various aspects of each technical section.

Studies conducted to fulfill human food safety data requirements are extensive and include mammalian toxicology, residue chemistry, and microbial food safety. The studies are performed to demonstrate the safety of food products derived from treated fish. The Upper Midwest Environmental Sciences Center is in the midst of a 6 year effort conducting AQUI-S™ residue chemistry studies. Completed studies include a total residue depletion and metabolism study and validation of an analytical method to determine drug residue concentrations in coldwater fish species (determinative method). Ongoing studies include validation of the determinative method in coolwater and warmwater fish species, validation of an analytical method to confirm the identity of drug residues in all fish species, and drug residue depletion studies with coolwater and warmwater fish species.

9. EVALUATION OF CALCEIN IMMERSION AND MEDICATED FEED TO MARK SHOVELNOSE STURGEON (*Scaphirhyncus platoryncus*), presented by Molly Bowman*.

Authors: Tom Bell, Greg Kindschi, Jim Bowker, and Molly Bowman*

*Molly Bowman
U.S. Fish and Wildlife Service
Aquatic Animal Drug Approval Partnership Program
4050 Bridger Canyon Road
Bozeman, MT 59715,
Tel: 406-994-9916
Fax: 406-582-0242
Email: molly_bowman@fws.gov

Marking fish is a widely used procedure to support a variety of fish management efforts. One such marking technique is the use of the fluorescent dye calcein. Calcein binds with calcium phosphate in bony fish tissue and the fluorescent marks can be detected non-lethally when viewed at proper wavelengths. Preliminary studies have demonstrated detectable marks via immersion or medicated feed application of calcein.

Preliminary results from a study conducted by the USFWS to evaluate detectable marks on fish immersed in or fed calcein have shown that administration of medicated feed may be a viable option to mass mark fish.

10. NON-LETHAL SPRING HEALTH ASSESSMENTS OF SPOTTED MUSKIES, presented by Corey Puzach*.

All actual presentations (#1-25) may be viewed by merely clicking on the title.

2006 Coolwater Fish Culture Workshop – January 8-10, 2006
Wintergreen Resort and Conference Center, Wisconsin Dells, Wisconsin

Authors: *Corey Puzach*,[1] Becky Lasee,[1] Terrence Ott,[1] Susan Marcquenski,[2] and Arunas Liskauskas[3]

*Cory Puzach
[1]La Crosse Fish Health Center
U.S. Fish & Wildlife Service
555 Lester Avenue, Onalaska, WI 54650
Tel: 608-783-8445
E-mail: corey_puzach@fws.gov

[2]Wisconsin Department of Natural Resources
Bureau of Fisheries Management and Habitat Protection
101 S. Webster Street
Madison, WI 53717
Tel: 608-266-2871
Fax: 608-266-2244
E-mail: susan.marcuenski@dnr.state.wi.us

[3]Ontario Ministry of Natural Resources
1450 7th Avenue East
Owen Sound, ON N4K 2Z1

The purpose of this study was to determine possible health risks associated with transferring fertilized spotted musky eggs from Lake Huron to Green Bay. Current importation regulations of the Wisconsin Department of Agriculture require lethal sampling of 20 fish. However, euthanasia of valuable musky brood stock was not practical; therefore non-lethal techniques for sampling were required. Pathogens of primary concern were the piscirickettsial-like-organism (PLO) described by Mohamed Faisal, Michigan State University, from Lake St. Claire muskies and *Renibacterium salmoninarum* (Rs) the causative agent of Bacterial Kidney Disease. Non-lethal samples were collected from spawning muskies from the Fox River, Southern Lake Huron and Northern Lake Huron by Wisconsin Department of Natural Resources and Ontario Ministry of Natural Resources staff. Screening for PLO's consisted of examining stained blood smears and tissue cell culture using media free of antibiotics. Blood, ovarian fluids and milt were inoculated onto KDM-2 media and incubated for Rs. Blood, milt and ovarian fluids were also used in standard virology assays using media with antibiotics. Whenever possible, laboratory screening followed the guidelines specified in the U.S. Fish & Wildlife Service/American Fisheries Society-Fish Health Section Standard Procedures for Aquatic Animal Health Inspections. PLO's were not found in 15 blood smears from the Fox River and 13 blood smears from Northern Lake Huron. PLO's were identified in one blood smear out of 28 blood smears examined from Southern Lake Huron. No PLO's were isolated in tissue cell culture. Viruses were not detected in pooled OF, milt or blood samples (diluted in HBSS with antibiotics) from the three sampling sites. Also, Rs was not detected from milt or ovarian fluids inoculated onto SKDM-2 plates from all sites. This study indicates that non-lethal methods were successful in detecting *Piscirickettsia*, a serious pathogen of muskies.

11. COMPARISON OF THERAPUTANTS TO REDUCE MORTALITY IN FINGERLING WALLEYE CAUSED BY COLUMNARIS DISEASE, presented by J. Allen Johnson*.

Authors: *J. Alan Johnson and James B. Rudacille

*J. Alan Johnson
Fisheries Research Biologist
Rathbun Fish Culture Research Facility
15053 Hatchery Place
Moravia, IA 52571
Tel: 641-647-2658
Fax:641-647-2690
E-mail: alan.johnson@dnr.state.ia.us

Each year, Rathbun Fish Hatchery (RFH) habituates 300,000 walleye fingerlings to prepared diets in order to produce 200 mm advanced fingerlings. During the habituation process, walleye fingerlings are under stress and subjected to abrasions during handling. As a result, outbreaks of external columnaris disease caused by *Flavobacter columnari* are a problem. Historically, bath treatments of Diquat herbicide have been utilized to control mortality related to external columnaris disease at RFH under an Investigational New Animal Drug permit (INAD 10-969). However, Diquat is an unlikely candidate for Food and Drug Administration approval; therefore alternative theraputants must be evaluated.

Chloramine-T (CHL-T) and hydrogen peroxide (H_2O_2) are two bath theraputants currently under INAD that have proven efficacious to control mortality from external columnaris in cool-water fish. This study compared use both of these theraputants to the use of Diquat during walleye habituation at Rathbun Fish Culture Research Facility.

Walleye were habituated in a dark room environment with submerged lighting for 28 days. Walleye were fed EPAC CW for the first ten days then transitioned to WG 9206 for the remainder of the trial. All raceways were treated with Diquat for the first three days post stock, after that, each of the three theraputants were applied to three replicate raceways.

The frequency of application was highest for raceways receiving CHL-T (15.7) compared to Diquat (11) and H_2O_2 (11.7) during the 28-day trial. Raceways of fish treated with Diquat and CHL-T had the highest survival rates compared to raceways treated with H_2O_2. Excessive mortality was observed in tanks treated with H_2O_2 after the treatment rate was increased form 75 to 100 mg/l. Final length of fingerlings treated with H_2O_2 was over 10 mm shorter than those treated with Diquat or CHL-T.

While these results appeared to indicate CHL-T was better than H_2O_2 in controlling mortality due to columnaris disease, further refinement to both theraputant treatment regimes is needed. Further research should evaluate differences in target and actual treatment concentrations to determine if theraputants are used at effective levels.

12. EYE FLUKE (*Diplostomum spathaceum*) IN POND-REARED WALLEYE, presented by Susan Marcquenski*.

Authors: *Susan Marcquenski[1], Bob Fahey[2], Steve Merson[2], and Paul Kruse[2]

[1] WI DNR Box 7921
Madison WI 53707
Tel: 608-266-2871
Fax: 608-266-2244
E-mail: Susan.marcquenski@dnr.state.wi.us

[2] WI DNR Lake Mills State Fish Hatchery
302 S. Main St.
Lake Mills WI 53551
Tel: 920-648-8012
Fax: 920-648-3646

Diplostomum spathaceum is a trematode or fluke that infects the eyes of fish throughout the world. The life cycle involves fish-eating birds, snails and fish. The Lake Mills hatchery coolwater water supply is Rock Lake, and walleye are typically reared from April through June and stocked as small fingerlings. In summer 2004, the Lake Mills hatchery reared 12,000 walleye in ponds from April through early October. By early August, hatchery staff noticed an unusual condition of the eye that was diagnosed as a *D. spathaceum* infection. At that time, about 5% of the fish had visible parasites in the eye. By early October, prevalence was about 80%. Fish were hand sorted and uninfected walleye were clipped and stocked into the Milwaukee harbor. Fifty walleye considered infected, and 50 walleye considered uninfected were reared over winter and examined in April 2005 to evaluate pathology and to see if the uninfected fish were truly uninfected. Thirty-four walleye in the infected group survived over winter; of these, 33 were infected and the mean intensity of infection was 2.3 (range 0-10). Of the 43 surviving walleye in the group considered uninfected, 21 fish were infected (49%) and mean intensity of infection was 0.9 (range 0-7).

In summer 2005, 3000 walleye were reared from April to September in a different pond. Access to the pond by birds was controlled; flows were reduced and minnow spawning structures (snail habitat) were not placed in the pond. By early August, prevalence of *D.s.* was 100% in a sub sample of 20 fish. Serendipitously, in June, about 3000 small fingerling walleye were transferred from a pond to indoor tanks supplied with well water and trained to eat pelleted feed. Fish were stocked back into a different pond in early August and after 30 days; fish remained free of the parasite. Subsequent monitoring of angler caught fish from Rock Lake has shown *D.s*. prevalences of 58% in bluegill and 100% in walleye 15-27 inches. We feel it may be possible to rear *D.s.*-free walleye at Lake Mills using a combination of extensive and intensive rearing methods.

Perch Session

13. Compact FLOATING RACEWAY CULTURE OF YELLOW PERCH AND BLUEGILL SUNFISH, presented by Dr. Chris Hartleb*.

* Dr. Chris Hartleb
UW Stevens Point, Dept. of Biology
800 Reserve Street
Stevens Point, WI 54481
Tel: 715-346-3228
Fax: 715-346-3624
E-mail: chartleb@uwsp.edu

Diversification of cultured fishes and innovative techniques for raising fish in cost efficient ways, while water resources increasingly become a limiting factor, continue to be a challenge for culturists. This study examined a compact floating raceway system to culture yellow perch and bluegills in ponds not previously used for fish culture. Floating raceways were constructed at a cranberry and fish farm and an agricultural site, where yellow perch were raised for two years and bluegills for one. Fish were monitored for growth and survival while being fed at 3% body weight/day. Juvenile perch showed an exponential increase in growth (R^2 = 0.95, 3.2-9.0 cm; 0.33-8.33 g), while adult perch exhibited linear increases in growth (R^2 = 0.95, 10.2-14.1 cm; R^2 = 0.94, 20.45-38.7 g). Bluegills doubled in length (R^2 = 0.95, 6.63-12.36 cm) and showed an eight-fold increase in weight (R^2=0.97, 4.7-35.2 g). TSS (0.0048 – 0.0053 mg/L), pH (6.8 – 7.3), hardness (171 mg/L), alkalinity (67 mg/L), and turbidity (4.4 NTU) showed no significant differences ($P > 0.05$) among raceways. Floating raceways permitted the simultaneous rearing of multiple species in one pond, with individual management of each stock. The manageable design and cost efficiency of this system is ideal for use in water bodies not previously suitable for fish culture.

14. GENETIC ANALYSIS OF NORTHERN AND SOUTHERN STRAINS OF YELLOW PERCH (*Perca flavescens*), presented by Rachel A Koehler*.

Authors: *Rachel A. Koehler, Chris Hartleb & Brian Sloss
UW Stevens Point, Dept. of Biology
800 Reserve Street
Stevens Point, WI 54481
Tel: 715-342-5991
Fax: 715-346-3624
E-mail: RKoeh231@uwsp.edu

The yellow perch (*Perca flavescens*) has a wide distribution across the United States and is a commercially valuable species that is common in aquaculture settings. Within the aquaculture community it is believed that there are (distinct) northern and southern strains of perch. Southern perch tend to grow larger, but it is unknown if this difference in growth is due to a longer growing season in the southern U.S. or to genetic differences between northern and southern fish. To determine if different strains of perch exist, DNA samples from a northern culture population, a southern culture population, and a wild population from Green Bay were collected. Measures of genetic variability such as genic differentiation, population subdivision, and mean number of

alleles per locus were examined by comparing microsatellites from the different populations. There were minor to no differences between the northern strain and Green Bay population with significant divergence between the northern groups and southern strains. Measures of genetic differentiation and allelic diversity between the populations suggest differences between fish from different geographic regions.

15. EARLY OUT-OF-SEASON PRODUCTION OF YELLOW PERCH FINGERLINGS, presented by James A. Held*.

Authors: *James A. Held[1] and J.A. Malison[1]

*James A. Held
[1]University of Wisconsin Aquaculture Program
302 South Main Street
Lake Mills, WI 53551
Tel: 920-648-2902
E-mail: ***jaheld@wisc.edu***

We employed out-of-season spawning techniques, rapid incubation and early pond stocking in yellow perch to extend the growing season for year one fingerlings. Perch broodstock were removed from a pond in mid-February and stocked into tanks indoors. Tank water temperature was increased to 12°C over the course of several days. After warming, gravid female broodstock were injected with 100 µg of hCG and returned to the tank. Male broodstock were freely spermiating and needed no hormonal manipulation. Between days 6 and 9 after injection, egg ribbons were stripped from the females, fertilized according to the dry method, and suspended on racks in a tank for incubation. Incubation water temperature was raised to 15°C within 1 day of fertilization. Twenty of 27 females produced intact egg ribbons, fertilization rates exceeded 95% and fry were hatched 7 to 8 days after fertilization. During the first week of March, hatched fry were stocked through a hole in the ice into 2 production ponds that had contained water throughout the winter (200,000 fish/acre). Microscopic examination of water samples revealed an abundance of protozoa, rotifers, and small copepods. After the ice melted, an inorganic fertilization protocol was followed to maintain plankton populations. Perch fingerlings were harvested in mid-July. Pond returns averaged 45% and fingerlings were approximately 33% larger than those produced during the normal spawning season. We have also successfully used early season spawning and rapid incubation techniques in walleye. Early pond stocking of walleye fry has not yet been attempted by our laboratory.

Sturgeon/Northern Pike/Muskellunge/Forage Session

16. 2005 LAKE STURGEON TRIALS AT THE GENOA NATIONAL FISH HATCHERY, presented by Nick Starzl*.

Nick Starzl*
Fishery Biologist
Genoa National Fish Hatchery
S5689 State Rd 35
Tel: 608-689-2605
Fax: 608-689-2644
E-mail: nick_starzl@fws.gov

The lake sturgeon has perplexed fish culturists by its resistance to accept prepared diets. Unlike some other species, lake sturgeon have not been efficiently reared on commercially available feeds. Consequently, the fish has to be fed an expensive frozen diet of chironomids, krill, or adult brine shrimp. This expensive diet can skyrocket the production price of the fish to a staggering $2.00 each. In an effort to reduce production costs, the Genoa NFH has been investigating cost saving techniques for the production of lake sturgeon. The staff at the Genoa National Fish Hatchery propagates up to 40,000 six inch sturgeon annually, and would benefit from the ability to feed this species commercially produced or modified diets.

During the summer of 2005, an experiment involving 6000 lake sturgeon was ran to investigate the ability to convert cultured fish onto a commercial diet at an early age(less than a month). It was decided to try a new diet this year from Inve. The diet came in a very small and consistent size which is very desirable for young lake sturgeon. Fish fed a regime of commercial diet mixtures did grow at a rate comparable to the fish fed the natural diets. Unfortunately, survival was significantly lower at only 5% compared to 97% being fed artemia nauplii. No further trials with this diet were undertaken due to the low survivability. Another diet which was used during the previous two years was Bio-Diet. It is a moist diet which had much higher results (35% survivability) while fish were being fed under similar conditions. Further studies using bio-diet were run in order to refine the technique of habituating the lake sturgeon off of brine shrimp and over to the prepared diet. The economic and propagation value of these trials may be substantial.

17. WR STURGEON REARING TECHNIQUES, presented by Rich Klett*.

*Rich Klett
Wisconsin DNR-Wild Rose SFH
N5871 State Hwy 22
Wild Rose, WI 54984
Tel: 920-622-3527
Fax: 920-622-3028

The Wild Rose Fish hatchery is the largest Coldwater fish Hatchery the Wis. DNR operates. Brown trout and Chinook salmon are the main coldwater species raised. In addition, a substantial number of coolwater fish are raised. The species are Great Lakes Spotted muskie, Northern Pike and Lake Sturgeon.

The Wild Rose Hatchery has raised Lake Sturgeon since the late 1970's. Current production is up to 50,000 fingerlings per year. Up to 5 different strains are kept separate for re-introduction or enhancement of sturgeon populations around the state. Many other agencies working on Lake Sturgeon re-introductions are supplied with eggs or fry from the Wild Rose Fish Hatchery. The Sturgeon are reared on live or frozen foods and a high percentage of fish are marked before stocking. Marking methods include fin clipping, PIT tagging and scute removal.

18. GOLDEN SHINER (*Notemigonus crysoleucas*) EGG PRODUCTION AND EFFECTS OF WATER TEMPERATURE ON SPAWNING, presented by Troy Clemment*.

Authors: Troy Clemment[1] and Nathan Stone[2]

[1]Wisconsin Department of Natural Resources, Kettle Moraine Springs SFH
N1929 Trout Spring Road
Adell, WI 53001
Tel: 920-528-8825
Fax: 920-528-8852
E-mail troy.clemment@dnr.state.wi.us

[2]Department of Aquaculture/Fisheries
Mail Slot 4912
1200 North University Drive
University of Arkansas at Pine Bluff
Pine Bluff, AR 71601

This study was done to determine the number of eggs produced by golden shiners (*Notemigonus crysoleucas*) over the spawning season and the relationship of daily egg production to environmental variables. Eight, 5.9 m^2 plastic-lined pools were each stocked 15 March, 2000 with 50 golden shiners, 9.2 $\pm$ 3.7 g (mean $\pm$ SD) in body weight each. Fish were fed once daily at 5% body weight with a 40% protein, 9% fat, extruded (pelleted) feed. A spawning substrate was placed in four randomly selected pools, while mats were not placed in the remaining four pools. For a 111-day period (16 March – 4 July), spawning mats were collected daily and replaced with clean ones. Eggs were removed in a 1.5% sodium sulfite bath and the total volume of eggs from each pool was recorded. The mean number of eggs per mL, based on counts of 27, 2-mL samples, was 704 (SD = 109). Spawning commenced within a day of stocking at mean water temperature of 15^{o}C and continued until the daily temperature averaged 30^{o}C. The number of eggs collected daily from individual pools ranged from 0 to 33,792 with season-long averages of 4,986 to 7,284 per day. There were only 4 days when no eggs were collected. Egg production peaked in May, when an average of 14,339 eggs were collected daily per kg of golden shiners. The mean number of eggs collected daily increased with water temperature up to a peak at 22^{o}C, then decreased as water temperature continued to increase. Approximately 2.75 million eggs were produced over the 111-day period by 2.4 kg of fish (mean of stocking and harvest weight). Egg production was not correlated with lunar phase, barometric pressure, and rainfall. Fish growth, condition, and gonadosomic index did not differ significantly between fish held with and without spawning substrate.

19. FORAGE MINNOW USE AND MANAGEMENT IN WEST CENTRAL REGION REARING PONDS, presented by Lee Goehring*.

*Lee Goehring
Wisconsin DNR-West Central Regional Fisheries Operations
910 Hwy 54 East
Black River Falls, WI 54615
Tel: 715-284-1443
Fax: 715-284-1737
E-mail: lee.goehring@dnr.state.wi.us

The West Central Region operates eleven different fish rearing ponds, currently producing muskellunge, northern pike, and walleye fingerlings for stocking into public waters in Wisconsin. Those reared to 8-10", large fingerling sizes are produced on a diet of zooplankton and forage minnows. Our approach is different than most other state facilities in that we use a combination of purchased, locally captured, and "recycled" fathead minnows, shiners, and white suckers, with an emphasis on in-pond fathead minnow reproduction. Local sources of forage minnows include public waters and the municipal sewage treatment facilities for two communities. The combination of local sources, in-pond reproduction, and salvage and reuse of surplus forage from production ponds has saved us thousands of dollars in forage purchase costs. A major issue we have identified and are currently addressing is how to accurately determine the level of fathead minnow reproduction in the ponds. Past experience and practices were based primarily on a "best guess" approach which is difficult to explain or repeat. Initial sampling efforts used a combination of fry collection and visual estimates of fry numbers at established sample sites at the ponds. Over time, we hope to establish some type of fry index relating the number of fry seen to the eventual fingerling production achieved in a given pond. We found a wide variation in results between two sampling approaches, so our approach will need some “fine tuning” to be useful.

20. EXPERIENCES IN NORTHERN PIKE SPAWNING AND FRY PRODUCTION AT SPIRIT LAKE FISH HATCHERY 2000-2005, presented by Robert R. Benedict*.

*Robert Benedict
122 252nd Avenue
Spirit Lake IA 512360
Tel: 712-336-1840
Fax: 712-336-0921
Email: Robert.benedict@dnr.state.ia.us

Iowa’s northern pike fingerling production was assigned to Spirit Lake Fish Hatchery in 2000 resulting in the need for substantial quantities of northern pike swim-up fry. Discussed are our experiences with different techniques used from 2000 to 2005 to meet this need. Included in the discussion are brood fish collection and handling, fertilization methods, egg hardening and incubation strategies, and methods employed in transitioning from sac fry to swim-up stage. What we have learned from these experiences resulted in the effective and efficient methods used to produce northern pike swim-up fry in 2005.

21. INTENSIVE CULTURE EVALUATION OF FOUR DIETS FED TO LARVAL NORTHERN PIKE AND MUSKELLUNGE presented by Kim Hawkins*.

*Kim Hawkins, Iowa DNR
Spirit Lake Fish Hatchery
122 252nd Ave
Spirit Lake, IA 51360
Tel: 712-336-1840
Fax: 712-336-0921
E-mail: Kim.hawkins@dnr.state.ia.us

Four diets were tested on a production scale on Northern Pike in the spring of 2005 for 21 days; Nutra HP, BioVita, Lansy CW, and Lansy NRD. On day 6, on-feed growth and survival were compared among diets. Fish fed HP(11,109/lb) were found to be significantly smaller than fish fed BioVita(9,107.8/lb), CW(9,397.2/lb), and NRD(9765.8/lb) ($F=13.89$, $p<.05$). After 21 days, final growth and survival were compared among diets. Fish fed HP (727.9/lb) remained significantly smaller than fish fed the other three diets (BioVita (580.55/lb), CW (527.67/lb), NRD(496.93/lb)), while fish fed BioVita were found to be significantly smaller than fish fed NRD and there was no significant difference found between fish fed CW and BioVita or fish fed CW and NRD ($F=19.25$, $p<.05$). Fish fed BioVita (91.06%) and HP (95.18%) survived better than fish fed CW(68.34%) and NRD(62.09%). Based on growth, final survival, and feed availability, the best diet for Northern Pike was BioVita.

Four starter diets were tested on a production scale on Muskellunge in spring 2005 for 24 days; Nutra Plus, BioVita, Lansy CW, and Lansy NRD. On day 10, on-feed growth and survival was compared among diets. Fish fed BioVita (10,785/lb) and Nutra Plus (10,544/lb) were significantly larger than fish fed NRD (18,897/lb) and CW (17,240/lb) ($F=40.05$, $p<.05$). Fish fed BioVita (93.75%) and Nutra Plus (91.05%) also survived better than fish fed Lansy CW (70.8%) or Lansy NRD (76.41%). After 24 days, final growth and survival were compared among diets. Fish fed BioVita (1299.8/lb) were significantly larger than the fish fed the other three diets (Nutra Plus (1710/lb), CW (2113.5/lb), NRD (1,786.8/lb)) ($F=11.77$, $p<.05$). Fish fed BioVita (66.6%) and Nutra Plus (62.5%) continued to survive better than the fish fed Lansy CW (23.2%) and Lansy NRD (10.7%). Based on growth, final survival, and feed availability, the best starter diet for Muskellunge was BioVita.

Facilities Session

22. NORTHERN AQUACULTURE DEMONSTRATION FACILITY UPDATE, presented by Gregory J. Fischer*.

*Gregory J. Fischer, Facility Director
UWSP Aquaculture Demo Facility
P.O. Box 165
Bayfield, WI 54814
Tel: 715-779-3461
Fax: 715-779-3486
E-mail: gfischer@uwsuper.edu

Overview of UW-Stevens Point Northern Aquaculture Demonstration Facility located in northern Wisconsin. Short case studies and some lessons learned on rearing extended growth walleyes in outdoor clay lined ponds and rearing of yellow perch in Recirculating Aquaculture systems.

23. DIG, OR NOT TO DIG - RELINING OLD OUTLET CULVERT IN REARING POND, presented by Neal Rosenberg*.

Neal Rosenberg*
Wisconsin DNR-West Central Regional Fisheries Operations
910 Hwy 54 East
Black River Falls, WI 54615
Tel: 715-284-1443
Fax: 715-284-1737
E-mail: rosenn@dnr.state.wi.us

24. THE WILD ROSE SFH COMPLIANCE AND RENOVATION PROJECT UP-DATE, presented by Steve Fajfer*.

*Steve Fajfer
Wisconsin DNR-Wild Rose SFH
N5871 State Hwy 22
Wild Rose, WI 54984
Tel: 920-622-3527
Fax: 920-622-3028
E-mail: fajfes@dnr.state.wi.us

The Wild Rose Fish Hatchery is nearly 100 years old. It is the largest Coldwater hatchery the Wisconsin DNR operates producing approximately 100,000 lb. of fish per year. The coolwater portion of the hatchery will also be renovated as part of Phase 2. Species reared include lake sturgeon, northern pike, spotted muskellunge and walleye pike. Much of the existing infrastructure is between 50 and 70 years old. This presentation deals with the process and progress to date on the upcoming renovation.

25. FISH HATCHERY IMPROVEMENT / RENOVATION PROJECTS - 2006 UPDATE, presented by Tom Johnson*.

*Tom Johnson
FishPro Consulting Engineers &Scientists
5201 South 6th Street Road
Springfield IL 62703-5143
Tel: 217-585-8333
Fax: 217-585-1890
E-mail: tjohnson@fishpro.com